AL-MUSTAQBAL UNIVERSITY

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Definition of Molecular Biology

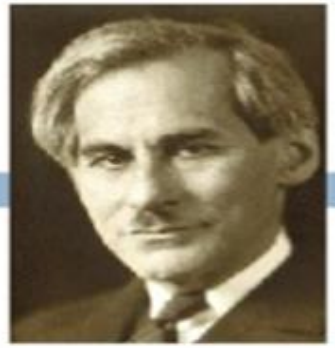
It is a combination of life sciences and chemistry that is concerned with studying the formation, composition, and function of large cellular molecules, such as nucleic acids and proteins, and their role in important biological activities, such as cellular replication and the transmission of genetic information.

Genetic Material

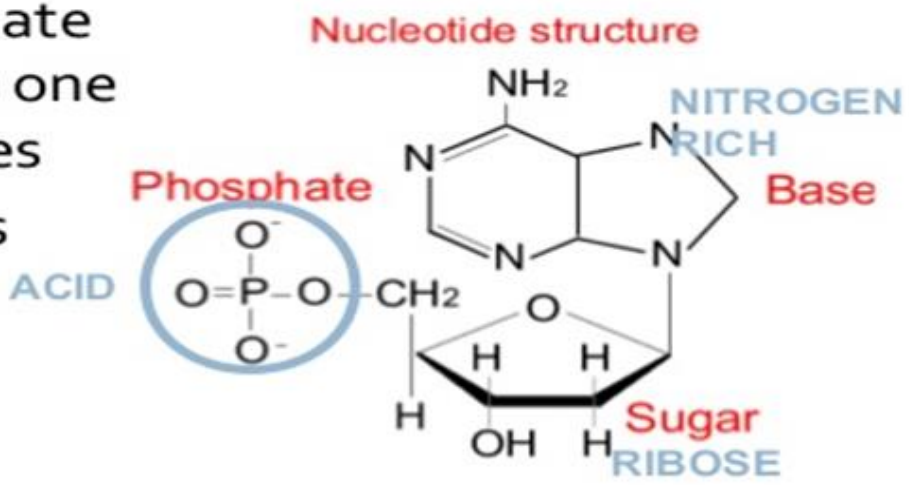
Genetic material is defined as the molecules that carry information and genetic characteristics (genotype) that encode phenotypic characteristics. For prokaryotic life, the genetic material is either deoxyribonucleic acid (DNA) or ribonucleic acid (RNA), while in eukaryotes it is in the form of deoxyribonucleic acid (DNA) only.

structure of DNA

1909 – Phoebus Levene



- Determined correctly that:
  - DNA made up of chains of nucleotides
  - a nucleotide is a phosphate linked to sugar linked to one of four nitrogenous bases
  - nucleotides link in series phosphate to sugar



structure of DNA

Phoebus Levene (1920's)

- identified the 3 components of DNA molecule
  - deoxyribose sugars
  - phosphate groups
  - nitrogenous bases
- 4 nitrogenous bases identified by 1949

structure of RNA

How's RNA composed?

RNA

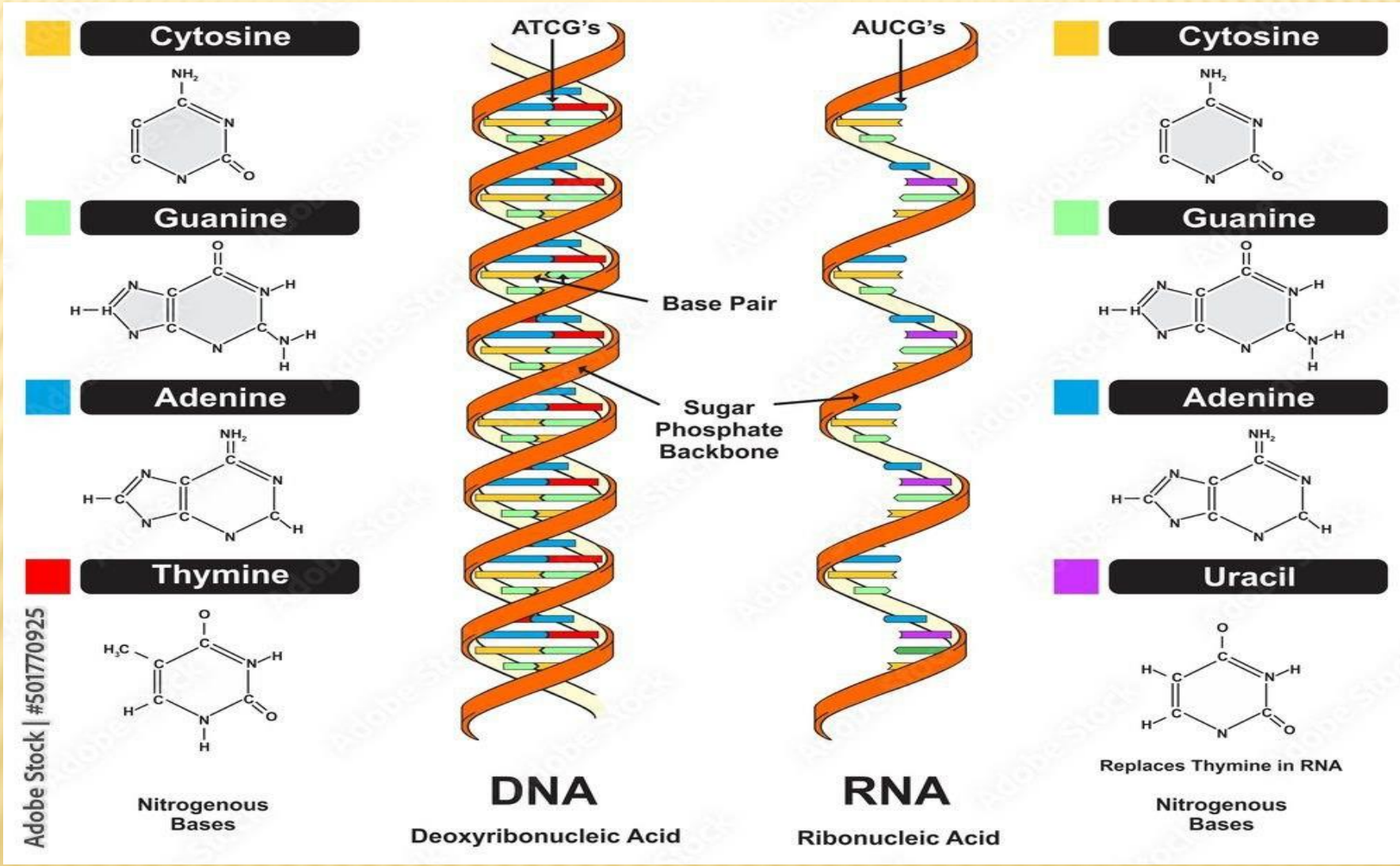
- Sugar
- Phosphate group
- Nitrogenous bases

RNA contains a sugar molecule called ribose. It's 5 carbon sugar

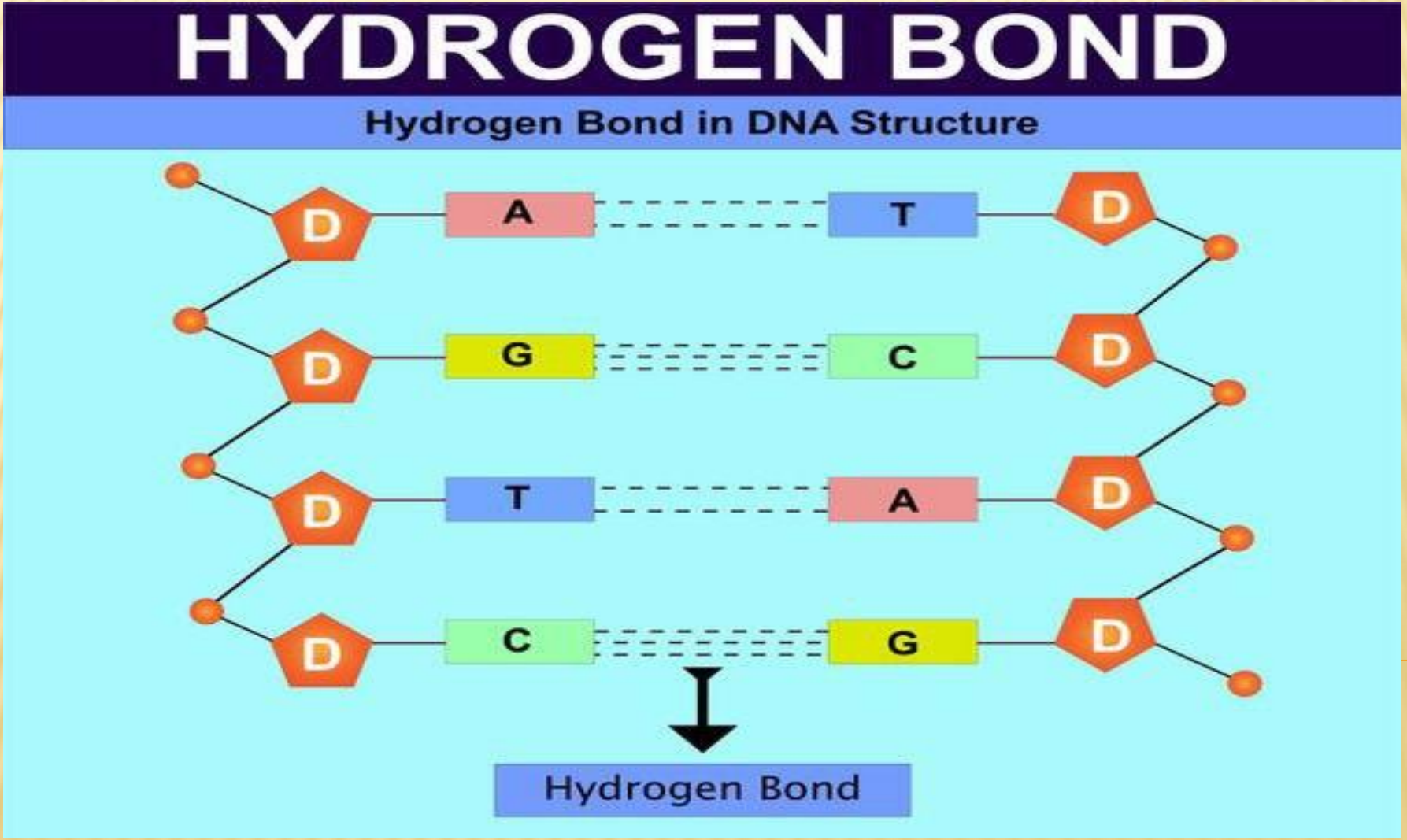
Each nucleotide in RNA is connected to a phosphate group

Four types: adenine (A), cytosine (C), guanine (G), and uracil (U)

Nitrogenous bases



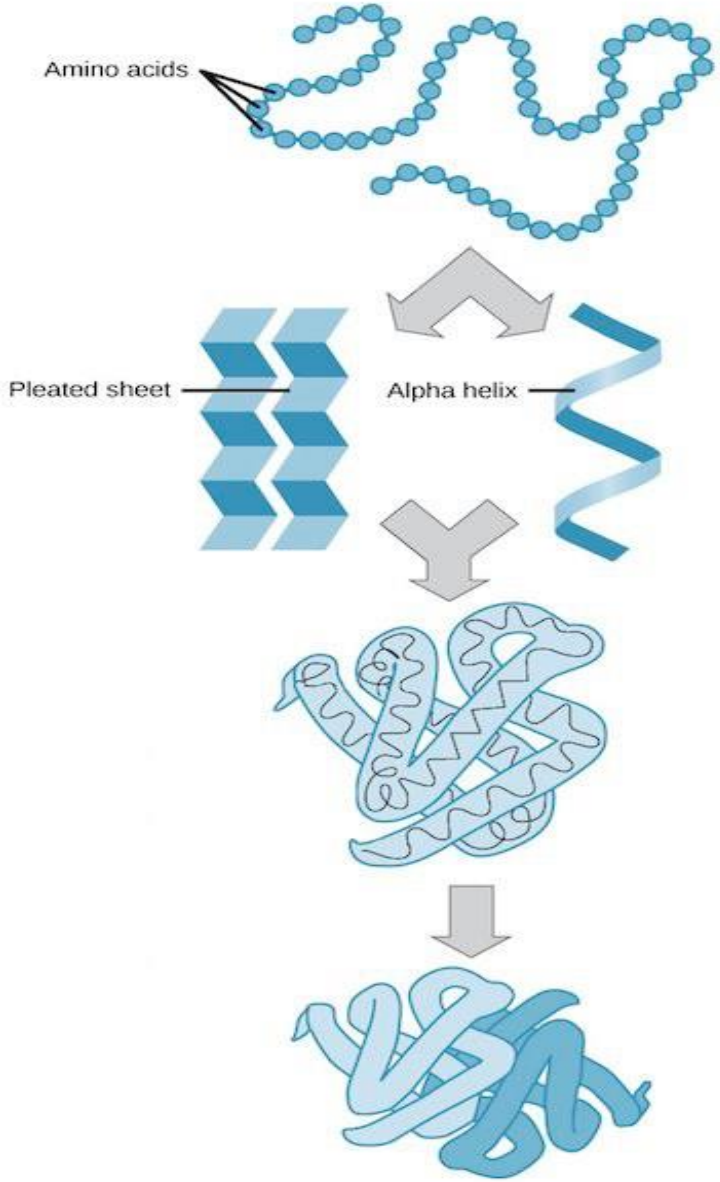
Nitrogenous bases



Protein structures

Protein structures are made by a series of amino acids that form peptide bonds. The sequence of amino acids in a protein is called its primary structure. Secondary structure is determined by the dihedral angles of the peptide bonds, and tertiary structure is determined by the folding of the protein chains in space. The binding of folded polypeptide molecules to complex functional proteins results in a quaternary structure

structure of protein



Primary protein structure
sequence of a chain of animo acids

Secondary protein structure
hydrogen bonding of the peptide backbone causes the amino acids to fold into a repeating pattern

Tertiary protein structure
three-dimensional folding pattern of a protein due to side chain interactions

Quaternary protein structure
protein consisting of more than one amino acid chain